



## A new species of *Zoniopoda* Stål (Orthoptera: Acridoidea: Romaleidae) from Argentina and its phylogenetic position within the genus

MARTINA E. POCCO<sup>1,3</sup>, GONZALO D. RUBIO<sup>2</sup> & M. MARTA CIGLIANO<sup>1</sup>

<sup>1</sup>División Entomología, Museo de La Plata, CCT La Plata, CEPAVE, CONICET-UNLP, Paseo del Bosque s/n, 1900, La Plata, Argentina

<sup>2</sup>CONICET. Cátedra de Diversidad Animal I, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Av. Vélez Sarsfield 299, X5000JJC Córdoba, Argentina

<sup>3</sup>Corresponding author. E-mail: [martinapocco@fcnym.unlp.edu.ar](mailto:martinapocco@fcnym.unlp.edu.ar)

### Abstract

A new species of the romaleid grasshopper genus *Zoniopoda* Stål (Romaleidae: Romaleini) is described and illustrated from the Sierras Chicas of Córdoba Province, central Argentina. A cladistic analysis based on morphological characters indicates that the genus *Zoniopoda* constitutes a monophyletic group and that *Zoniopoda serrana* n. sp. must be assigned to Iheringi species group based on synapomorphies of the pronotum and body color. The new species is similar to *Z. similis* Bruner from Paraguay, Bolivia and Brazil, from which it can be distinguished by the color pattern of the body, shape of the pronotal dorso-median carina and characters of the male terminalia and epiphallus. This paper has been formatted with embedded links to images of the type specimen, maps based on georeferenced specimen data for the genus and an updated key to the species of *Zoniopoda* available on the Orthoptera Species File (OSF) online (<http://orthoptera.speciesfile.org>).

**Key words:** Romaleini, grasshoppers, *Zoniopoda serrana* n. sp., Sierras Chicas

### Introduction

The family Romaleidae (lubber grasshoppers), mainly distributed in the Neotropical Region, is one of the most diverse native South American families, with representatives in wide range of habitats, from semi-arid conditions to tropical rain forest (Carbonell 1977). Romaleini is the only romaleid tribe known to occur in Argentina, with 36 species distributed in this country (Eades *et al.* 2010; Carbonell *et al.* 2006). The Romaleini genus *Zoniopoda* Stål was recently revised by Carbonell (2007) and comprises ten valid species divided into two groups based on body color patterns and characters of the dorsal median carina of the pronotum. All known species of this genus occur in the southern part of South America, east of the Andes. Although there is not much information about the general habitat of all the species, it seems that some of them prefer grasslands while others inhabit arbustive vegetation (Carbonell 2007). In Argentina, *Z. tarsata* is the only species of economic importance (Lange *et al.* 2005; Carbonell *et al.* 2006), with damages reported in San Juan, La Pampa and Buenos Aires provinces, mainly on alfalfa crops, native grasslands, olive groves and tobacco plantations (COPR 1982).

The Tarsata species group comprises species with body and legs marked with black and other colors in characteristic patterns and dorsal carina of the pronotum smooth in lateral view, while the species of the Iheringi group are characterized by the body uniformly green, tarsi and hind tibiae (sometimes also middle tibiae) may be red and dorsal carina of pronotum granulate or denticulate in lateral view (Carbonell 2007).

Only four out of the ten known species of *Zoniopoda* occur in Argentina, two of them belong to the Tarsata species group [*Z. omnicolor* (Blanchard) and *Z. tarsata* (Serville)] and the other two, *Z. iheringi* Pictet & Saussure and *Z. juncorum* Berg, to the Iheringi species group.

Recent surveys in Cerro La Banderita from the Sierras Chicas mountain range of Córdoba province (Argentina) resulted in the discovery of a new species of *Zoniopoda* found in grasslands between 1300 to 1420 meters of altitude.

The purpose of this paper is to describe this new species of *Zoniopoda*, *Z. serrana* n. sp., to provide a brief diagnosis and description, to illustrate the characters that allowed its identification and to analyze the phylogenetic position of this species within the genus.

## Material and methods

**Material.** Sampling was performed with an entomological net in Cerro La Banderita, Sierras Chicas, Córdoba province, central Argentina, between 1300 to 1420 meters of altitude. Specimens examined were deposited in the Orthoptera collection of the Museo de La Plata, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina (MLPA).

**Specimen preparation.** Male genitalia were dissected and cleared in potassium hydroxide and stored in glycerin. Illustrations were made as pencil sketches using a camera lucida attached to a Nikon SMZ1000 stereomicroscope. Photographs in natural habitat were captured with a Nikon D60 digital camera and of the male habitus with a Canon EOS Rebel digital camera. Images of the distal segments of the abdomen and phallic complex were captured with a Micrometrics digital camera attached to the microscope. The program Combine Z5.3 (Hadley 2006) was used for focus stacking (a technique which combines multiple images taken at different focal distances to give a resulting image with a greater depth of field than any of the individual source images). Species distribution was mapped with the software DIVA-GIS 5.4 (Hijmans *et al.* 2005).

Measurements are given in millimeters. Body length is measured from the fastigium verticis to the apex of tegmina at rest. The specimens measured correspond to the material designated as holotype, allotype and paratypes.

**Cladistic analysis.** The phylogenetic analysis was conducted on a matrix consisting of 13 species (11 ingroup and 2 outgroup) and 26 morphological characters. We considered only the *Zoniopoda* species treated by Carbonell (2007) in his recent revision of the genus. The list of characters was constructed based on the taxonomic revision of Carbonell (2007) and from the direct study of specimens. Morphological characters comprised structures from the head and thorax, male genitalia and coloration patterns. Although coloration in Romaleidae is known to be variable and is sometimes affected by local environmental conditions, the body color characters used in this analysis were invariable at the intraspecific level and appear to be heritable. The morphological characters and their states are listed in Appendix 1 and some of them are shown in Figs. 4 and 5. The data matrix is presented in Appendix 2. Tree searches were conducted in TNT (Goloboff *et al.* 2003) under the implicit enumeration option. All characters were considered to be of equal weight, and multistate characters were treated as unordered. Support for individual nodes was assessed by calculation of absolute Bremer support values (Bremer 1994) and bootstrap. Winclada (Nixon 2002) was used to map the characters and plot the tree. Characters were polarized by outgroup comparison with *Diponthus cribratus* (Serville) and *Chromacris speciosa* (Thunberg). The root was set as *D. cribratus*.

**Electronic content and hyperlinks.** This publication includes ‘hyperlinks’ (embedded links that allow simple redirection to online resources via the internet) and has been formatted with embedded links to images of the type specimen, to an updated species key of *Zoniopoda* and to a distribution map of *Zoniopoda* available on the Orthoptera Species File (OSF) online (<http://orthoptera.speciesfile.org>, Eades *et al.* 2010).

## Taxonomy

### Genus *Zoniopoda* Stål, 1873

Type species: *Acridium tarsatum* Serville, 1831

### *Zoniopoda serrana*, n. sp.

(Figs. 1A–D; 2A–I)

Holotype male (<http://orthoptera.speciesfile.org/Common/basic/ShowImage.aspx?TaxonNameID=78162&ImageID=72737>) and allotype female, ARGENTINA: Córdoba, La Falda, Cerro La Banderita (31° 04' 48.23" S, 64° 27' 31.28" W), 1419 m, 07/03/2010, M. Pocco, G. Rubio & M. Rubio, MLPA. Paratypes: 2 males, 1 female, ARGENTINA: Cór-

doba, La Falda, Cerro La Banderita (31° 04' 48.31" S, 64° 27' 31.67" W), 1418 m, 06/02/2010, G. Rubio, MLPA; 4 males, 6 females, Córdoba, La Falda, Cerro La Banderita (31° 04' 48.45" S, 64° 27' 42.69" W), 1300 m, 07/03/2010, M. Pocco, G. Rubio & M. Rubio, MLPA; 8 males, 1 female, Córdoba, La Falda, Cerro La Banderita (31° 04' 48.23" S, 64° 27' 31.28" W), 1419 m, 07/03/2010, M. Pocco, G. Rubio & M. Rubio, MLPA.

**Etymology.** *Serrana* (Sp.), hill, referring to the distribution area in the Sierras Chicas of Córdoba. The gender is feminine.

**Diagnosis.** Dorsal median carina of pronotum prominent, slightly granulate in lateral view, cut by deep transverse sulci (Fig. 2B). Male furculae set far apart and with rounded apex; epiproct with straight sides proximally and convergent at an obtuse angle distally (Fig. 2C). Body color greenish-yellow with light-blue (Figs. 1A–B, 2A); pronotal disk with wide yellow band along median dorsal carina and with two light greenish-yellow stripes along the lateral carinae; lateral lobes of pronotum with two yellow longitudinal bands along the middle area and the lower margin (Fig. 2B). Epiphallus with prominent subrectangular lophi (as seen from above) with oblique distal margin (Figs. 2F–I).

**Description.** Integument rugose, except on top and postocular areas of the head, and on legs (Figs. 1A, 2A). Dorsal median carina of pronotum high, slightly granulate in lateral view, cut by three deep transverse sulci (Fig. 2B). Prozona slightly longer than metazona. Male abdominal terminalia (Fig. 2C) with furculae set far apart and with rounded apex; epiproct with straight sides proximally, and convergent at an obtuse angle distally. Male phallic complex (Figs. 2D–E) as in the remaining species of *Zoniopoda*, only differing in the shape of the epiphallus. Epiphallus with prominent subrectangular lophi (as seen from above) with oblique distal margins (Figs. 2F–I).

Males: body color greenish-yellow with light-blue (Figs. 1A, 2A). Antennae black with yellow scape; each antennal segment with whitish distal end, in living specimens (Figs. 1A). Head greenish-yellow; antennal sockets, occiput and postgenae with spots of light-blue; fastigium, frontal costa and mouthparts with red markings. Pronotal disk light-blue with wide yellow band along median dorsal carina and two narrow light greenish-yellow stripes along lateral carinae; lateral lobes of pronotum with two yellow longitudinal bands, one along the middle area and the other one along the lower margin (Fig. 2B). Meso and metapleurae light-blue, with two oblique greenish yellow bands. Tegminae light-blue, with well marked yellow veins, especially the subcosta (SC), radius (R), second cubital (CuP) and anal veins. Hind wings with remigium greenish and vannus bluish. Fore and middle legs yellowish-green with red markings on coxae, tips of tibiae and tarsi; hind femora yellowish-green, outer face blue with light-blue pinnae, inner face with light-blue markings, rotular area pale red. Hind tibiae with inner face yellowish-green and outer face greenish light-blue, tips of tibiae and tarsi bright red. Abdominal tergites light-blue, with an oblique yellow band near lateral edges. Terminalia (Fig. 2C): subgenital plate and cerci cream, furculae black, epiproct black with a median cream-colored band.

Females (Fig. 1B): similar to males, but more robust. Ovipositor valves of soil-laying type, cream colored, with the tips dark red.

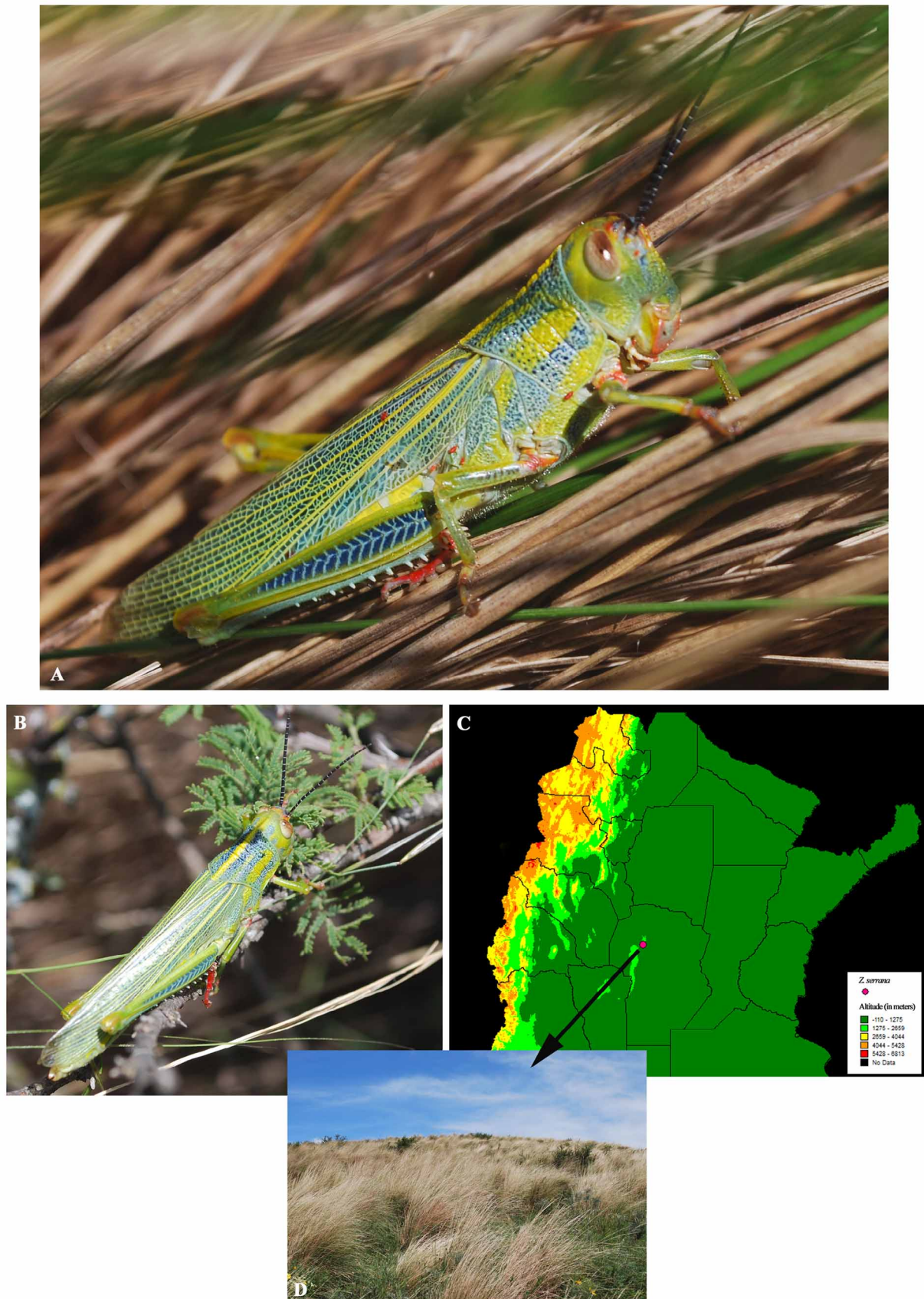
**Measurements.** Body length: 34.5 mm (33–37) males, 45.6 mm (45–47) females; prozona length: 3.2 mm (2.95–3.42) males, 4.22 mm (3.95–4.41) females; metazona length: 3.05 mm (2.84–3.27) males; 4.2 mm (4.01–4.48) females; hind femur length: 14.3 mm (13.5–15.5) males; 19.24 mm (18.5–20) females.

**Relationships.** Based on the characters of pronotum and body color *Z. serrana* is included in the Iheringi species group that was shown to be monophyletic in the cladistic analysis presented herein. From the species that constitute the Iheringi group, *Z. serrana* is readily differentiated from *Z. similis* Bruner, the most similar species, by the following characters: antennae black; dorsal median carina of pronotum prominent; epiproct with straight sides convergent distally at an obtuse angle; male furculae set far apart and with rounded apex; pronotum with a wide yellow band along median dorsal carina, two narrow light greenish-yellow stripes along lateral carinae and two yellow longitudinal bands on lateral lobes; epiphallus with prominent subrectangular lophi (as seen from above) with oblique distal margin. Table 1 illustrates the differences between these species.

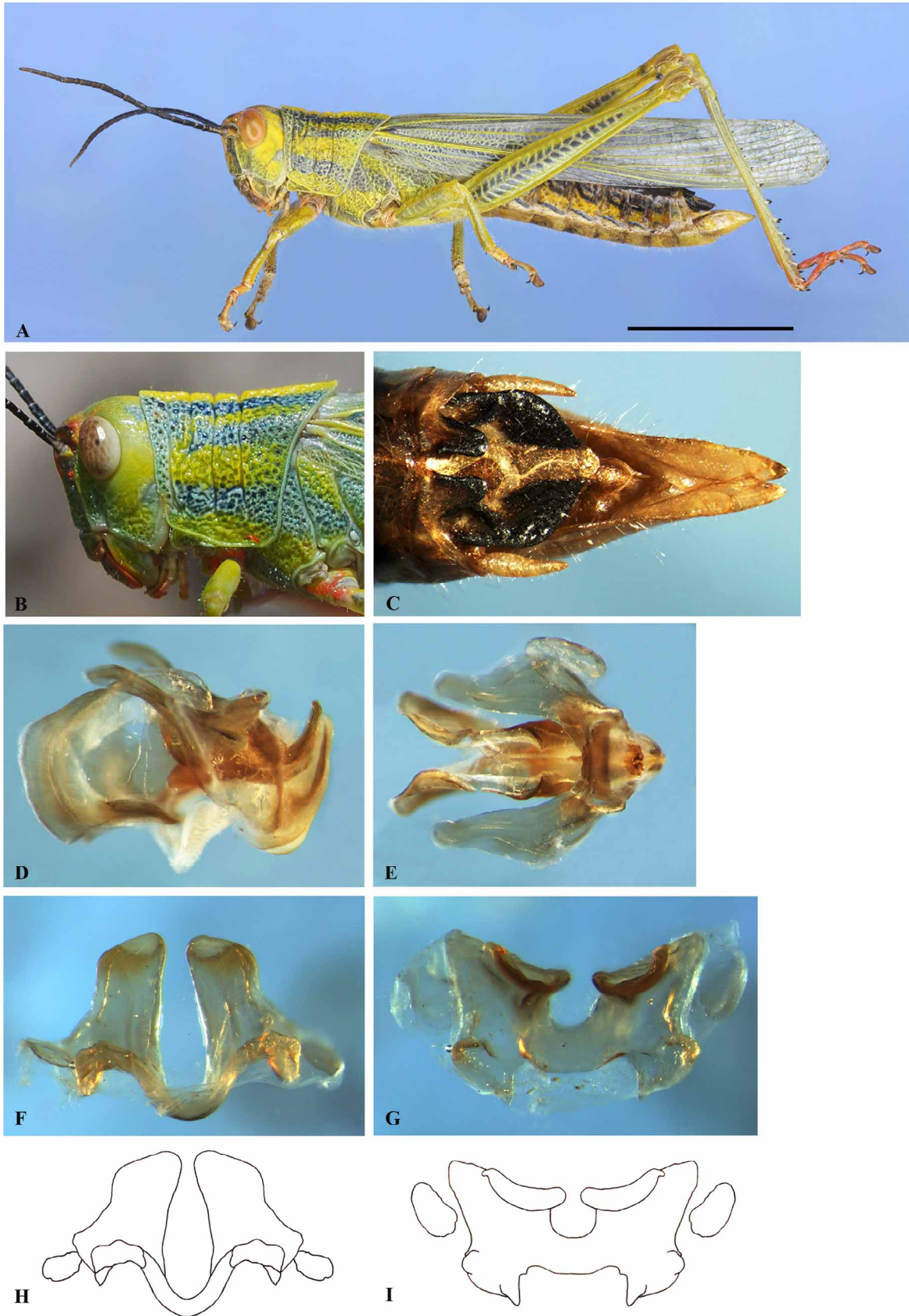
The key (<http://orthoptera.speciesfile.org/Common/key/KeyDriver1.aspx?BlockID=1751>) to the species of *Zoniopoda* based on Carbonell's (2007) revision of the genus was modified and updated to include *Z. serrana* in the Orthoptera Species File online (<http://orthoptera.speciesfile.org/>).

**Distribution and habitat.** The species is known from Cerro La Banderita, in the Sierras Chicas mountain range, La Falda, Córdoba, Argentina (Fig. 1C), where individuals were found only above 1300 meters of altitude (see <http://orthoptera.speciesfile.org/Common/editTaxon/Distribution/SpecimensMap.aspx?TaxonNameID=75173> geographic distribution of the species group in the Orthoptera Species File). The vegetation consisted of tall grasses

and herbaceous dicots (Fig. 1D). Below the mentioned altitude and in the other mountaintops surveyed from Sierras Chicas mountain range, only specimens of *Zoniopoda tarsata* were found.


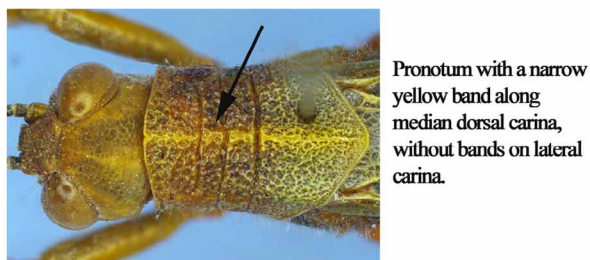



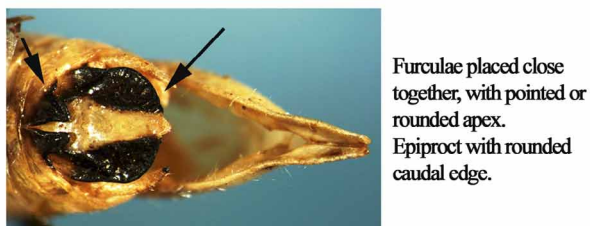
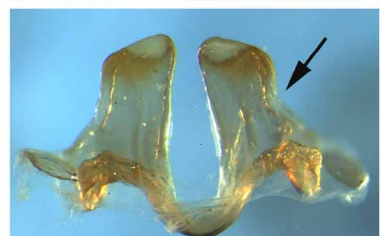
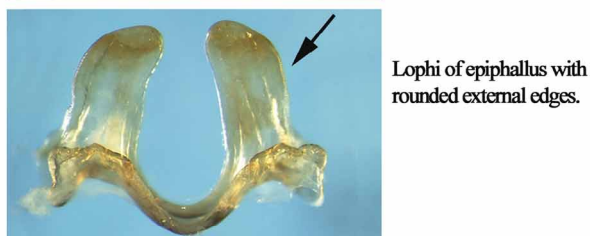


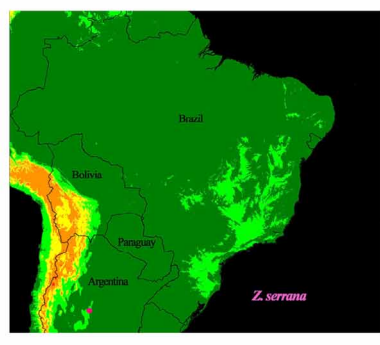
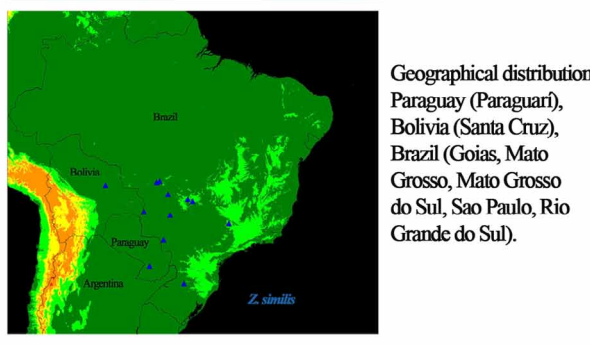


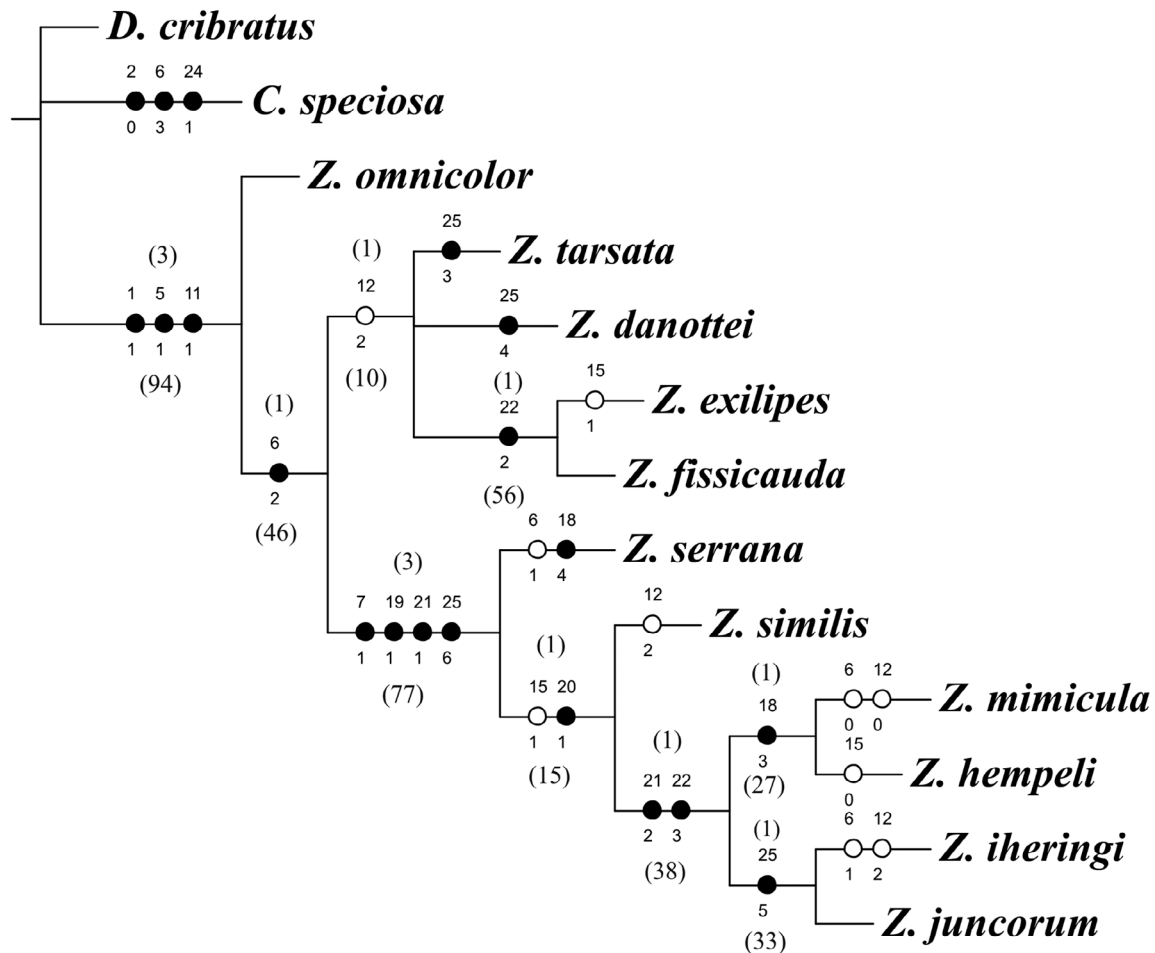
**FIGURE 1.** A, male *Z. serrana* n. sp.; B, female *Z. serrana* n. sp.; C, distribution map; D, natural habitat of *Z. serrana*.



**FIGURE 2.** A–I, *Z. serrana* A, male habitus (scale bar = 1 cm); B, head and pronotum, lateral view; C, male abdominal terminalia, dorsal view; D, phallic complex without epiphallus, lateral view; E, phallic complex without epiphallus, dorsal view; F, H, epiphallus, frontal view; G, I, epiphallus, dorsal view.

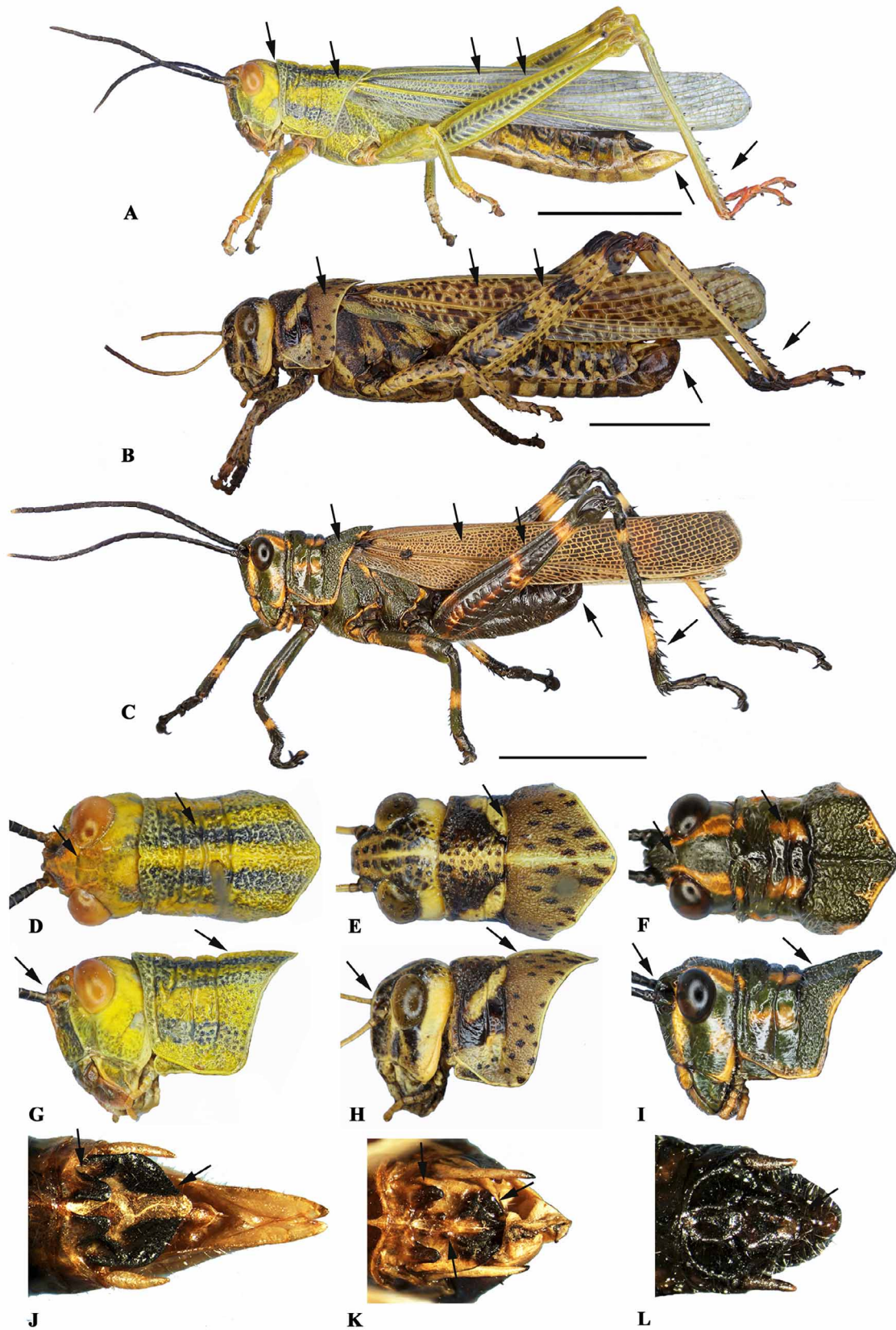
TABLE 1. Diagnostic characters to identify *Z. serrana* n. sp. from *Z. similis* Bruner.

<i>Zoniopoda serrana</i>		<i>Zoniopoda similis</i>	
	<p>Pronotum with a wide yellow band along median dorsal carina and two narrow light greenish-yellow stripes along lateral carina.</p>		<p>Pronotum with a narrow yellow band along median dorsal carina, without bands on lateral carina.</p>
	<p>Lateral lobes of pronotum with two yellow longitudinal bands. Median dorsal carina high, slightly granulate. Antennae black.</p>		<p>Lateral lobes of pronotum without bands. Median dorsal carina low. Antennae cinnamon.</p>
	<p>Furculae set far apart, with rounded apex. Epiproct with straight sides convergent laterally at an obtuse angle.</p>		<p>Furculae placed close together, with pointed or rounded apex. Epiproct with rounded caudal edge.</p>
	<p>Epiphallus with prominent subrectangular lophi with oblique distal margin and external edge with a slight constriction.</p>		<p>Lophi of epiphallus with rounded external edges.</p>
	<p>Lophi less developed horizontally, in dorsal view.</p>		<p>Lophi well developed horizontally, in dorsal view.</p>
	<p>Geographical distribution: Argentina (Córdoba).</p>		<p>Geographical distribution: Paraguay (Paraguari), Bolivia (Santa Cruz), Brazil (Goias, Mato Grosso, Mato Grosso do Sul, Sao Paulo, Rio Grande do Sul).</p>



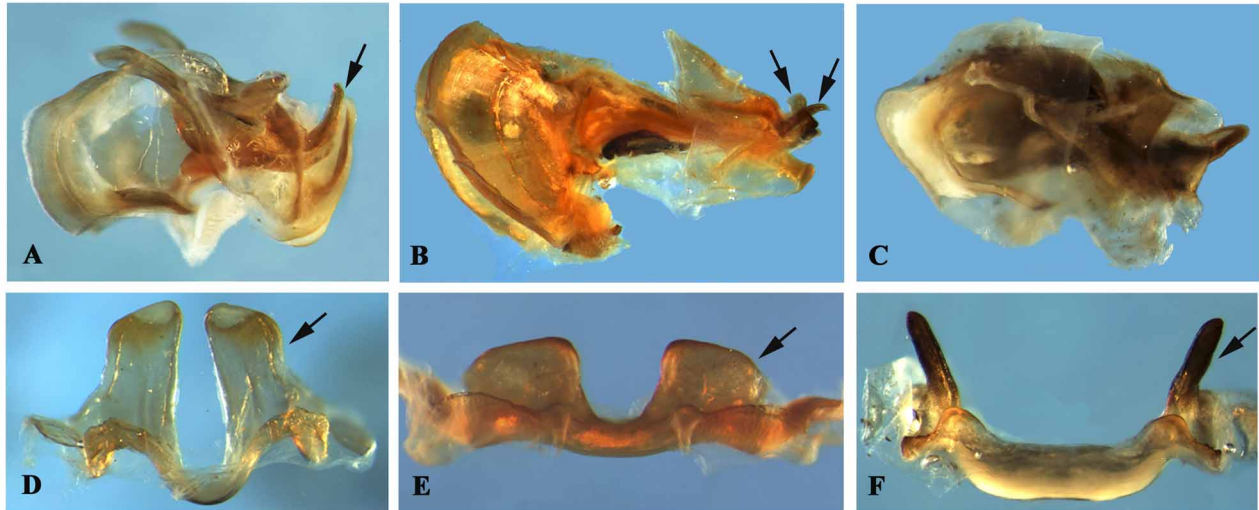
**FIGURE 3.** Most parsimonious tree of the genus *Zoniopoda* (length 56, consistency index = 0.85, retention index = 0.80) resulting from the cladistic analysis of the unordered morphological character dataset. Black circles indicate unique changes, and white circles indicate homoplasies. The numbers below the nodes are bootstrap support, and those above are Bremer support.

**Cladistic analysis.** A parsimony analysis of the data matrix (Appendix 2) resulted in one most parsimonious tree of length 56 (consistency index, 0.85; retention index, 0.80) (Fig. 3). The analysis recovered *Zoniopoda* as a monophyletic group based on the following synapomorphies: union frons-fastigium angulated in lateral view (1:1) (Fig. 4G); anterior margin of pronotum slightly projected over occiput (5:1) (Fig. 4A); subgenital plate long with acute and bifurcate apex (11:1) (Fig. 4J), with the highest support values. *Zoniopoda omnicolor* was shown to be the most basal species of the genus with the remaining species grouped into a clade supported by one synapomorphy (6:2, median dorsal carina of pronotum low throughout). Within this clade two groups were recovered: the first comprising *Z. tarsata*, *Z. danotiei*, *Z. exilipes* and *Z. fissicauda* united by the epiproct rhomboidal with rounded edges (12:2); and the second comprising *Z. serrana* and the species of the Iheringi species group (*Z. similis*, *Z. mimicula*, *Z. hempelii*, *Z. iheringi* and *Z. juncorum*), supported by four synapomorphies: median dorsal carina of pronotum granulated or denticulate in lateral view (7:1) (Fig. 4G); general coloration greenish, not mottled (19:1) (Fig. 4A); color pattern of hind tibiae without bands, greenish and tips bright red (21:1) (Fig. 4A); integument on metazona coarsely rugose, with upper parts of the rugae of same color (25:6) (Fig. 4A). *Zoniopoda serrana* was recovered as sister-group to the rest of the Iheringi group which it shares a single synapomorphy (20:1, color pattern of body and hind femora uniformly green). Within the Iheringi group two clades were depicted, related by two synapomorphies (21:2, color pattern of hind tibiae without bands, salmon, light red or reddish; 22:3, color pattern of pronotum without bands), one clade comprising the sister taxa *Z. mimicula* and *Z. hempelii* supported by one synapomorphy (18:3, lophi of epiphallus prominent, subrectangular with pointed edges) and the other clade comprising *Z. iheringi* and *Z. juncorum* united by the integument of the metazona tuberculate (25:5).



**FIGURE 4.** Some morphological characters used in the phylogenetic analysis are indicated with arrows. A–C, male habitus, lateral view: A, *Z. serrana* n. sp., B, *D. cribratus*, C, *C. speciosa*; D–I, male head and pronotum, dorsal and lateral views: D, G, *Z. serrana*, E, H, *D. cribratus*, F, I, *C. speciosa*; J–L, male abdominal terminalia, dorsal view: J, *Z. serrana*, K, *D. cribratus*, L, *C. speciosa*.





**FIGURE 5.** Some morphological characters used in the phylogenetic analysis are indicated with arrows. A–C, phallic complex without epiphallus, lateral view: A, *Z. serrana*, B, *D. cribratus*, C, *C. speciosa*; D–F, epiphallus, frontal view: D, *Z. serrana*, E, *D. cribratus*, F, *C. speciosa*.

## Discussion

The cladistic analysis conducted in this study recovered two clades within *Zoniopoda*, one comprised of the Iheringi species group (*Z. iheringi* Pictet & Saussure, *Z. juncorum* Berg, *Z. similis* Bruner, *Z. mimicula* Rehn and *Z. hempeli* Bruner) including *Z. serrana* n. sp. and the other one comprising the Tarsata species group (*Z. tarsata* (Serville), *Z. exilipes* Bruner, *Z. fissicauda* Bruner, *Z. danottei* Carbonell), excluding *Z. omnicolor* (Blanchard) that was shown to be the most basal species of the genus and sister-group to a clade comprising the Tarsata and Iheringi species groups.

In a recent review of *Zoniopoda*, Carbonell (2007) mentioned that the species within the Iheringi species group, which are all yellowish-green, are more difficult to differentiate than the species within the Tarsata species group. The species within the Iheringi group are identified by some minor characters such as the profile of the pronotum, the shape of the epiproct, the shape of the epiphallus and color patterns of the body. In this respect, *Z. serrana* is not unlike other members of the Iheringi group and only a few characters are useful in confidently differentiating this species from the similar species, *Z. similis*. While *Z. serrana* is endemic to the Sierras Chicas in Córdoba, central Argentina at altitudes above 1300 meters, the remaining species of the Iheringi group show widespread distribution in eastern Bolivia, Southern Brazil, eastern Paraguay and northern and eastern Argentina. The only species sympatric with *Z. serrana*, is the widespread *Z. tarsata* that belongs to the Tarsata species group. However, *Z. tarsata* was found at lower elevations in the Sierras Chicas mountain range of Córdoba (see <http://orthoptera.speciesfile.org/Common/edit/TaxonDistributionSpecimensMap.aspx?TaxonNameID=40174> the geographic distribution of the genus in the Orthoptera Species File online).

## Acknowledgements

We want to express our gratitude to Prof. Carlos S. Carbonell and Sam W. Heads for the revision of this manuscript.

## References

- Bremer, K. (1994) Branch support and tree stability. *Cladistics*, 10, 235–304.
- Carbonell, C.S. (1977)[1978] Origin, evolution and distribution of the neotropical acridomorph fauna (Orthoptera): a preliminary hypothesis. *Revista de la Sociedad Entomológica Argentina*, (1977) 36(1–4), 153–175.
- Carbonell, C.S. (2007) The genus *Zoniopoda* Stål 1873 (Acridoidea, Romaleidae, Romaleinae). *Journal of Orthoptera Research*, 16(1), 1–33.
- Carbonell, C.S., Cigliano, M.M. & Lange, C.E. (2006) *Especies de Acridomorfos (Orthoptera) de Argentina y Uruguay [Acridomorph (Orthoptera) species of Argentina and Uruguay]*. CD ROM. Publication on Orthoptera Diversity. The Orthopterists' Society.
- C.O.P.R. (1982) *The locust and grasshopper agricultural manual*. Published by the Centre for Overseas Pest Research, London, vii + 690 pp.
- Eades, D.C., Otte, D., Cigliano, M.M. & Braun, H. (2010) *Orthoptera Species File Online*. Version 2.0/3.5. Available from: <http://Orthoptera.SpeciesFile.org> (12/17/2010).
- Goloboff, P.A., Farris, S. & Nixon, K. (2003) *Tree Analysis Using NewTechnology*. Published by the authors, Tucumán [WWW document]. URL <http://www.cladistics.com/aboutTNT.html> [accessed in 2008].
- Hadley, A. (2006) *CombineZ5*. Available from: <http://www.hadleyweb.pwp.blueyonder.co.uk/CZ5/combinez5.htm>
- Hijmans, R.J., Guarino, L., Jarvis, A., O'Brien, R., Mathur, P., Bussink, C., Cruz, M., Barrantes, I. & Rojas, E. (2005) *DIVA-GIS, version 5.2 (upgrade)*. Available at <http://www.diva-gis.org/>
- Lange, C.E., Cigliano, M.M. & De wysiecki, M.L. (2005) Los acridoideos (Orthoptera: Acridoidea) de importancia económica en la Argentina. In: Barrientos Lozano, L. & P. Almáguer Sierra (eds.), *Manejo integrado de la langosta centroamericana (Schistocerca piceifrons piceifrons, Walker) y acridoideos plaga en América Latina*. Instituto Tecnológico de Ciudad Victoria, Tamaulipas, México, 93–135.
- Nixon, K.C. (2002) *Winclada, Version 1.00.08*. Published by the author, Ithaca, New York.
- Serville, J.G. Audinet (1831) Revue methodique des insectes de l'Ordre des Orthoptères. *Annales des Sciences Naturelles*, Paris, 22, 28–65, 134–167, 262–292. [Note: acridoids in pp 262–292.]
- Stål, C. (1873) *Recensio orthopterorum. Revue critique des Orthoptères décrits par Linné, De Geer et Thunberg*. Norstedt and Söner, Stockholm, part 1, 154 pp.

### APPENDIX 1. List of characters and states used in the phylogenetic analysis of *Zoniopoda*.

#### Head and thorax:

0. Antennae: shorter or slightly longer than head+pronotum (0) (Fig. 4B); considerably longer than head+pronotum (1) (Figs. 4A,C)
1. Union frons-fastigium in lateral view: quite rounded (0) (Figs. 4H-I); angulated (1) (Fig. 4G)
2. Frontal carina: absent below the median ocellus (0); present below the median ocellus, reaching the epistomal suture (1)
3. Transverse furrow on interocular space: absent (0) (Fig. 4E); present (1) (Figs. 4D,F)
4. Prosternal tubercle: compressed and retrorse (0); conical, straight and spiniform (1)
5. Pronotal front margin: not projected over occiput (0) (Figs. 4H-I); slightly projected over occiput (1) (Fig. 4G)
6. Median dorsal carina of pronotum: almost obsolete on prozone, slightly marked on metazone (0) (Figs. 4E,H); high throughout (1) (Figs. 4D,G); low throughout (2); almost obsolete on prozone, highly marked on metazone (3) (Figs. 4F,I)
7. Median dorsal carina of pronotum, in lateral view: smooth (0) (Figs. 4H,I); granulated or denticulate (1) (Fig. 4G);
8. Median dorsal carina of pronotum: cut by one transverse sulcus (0) (Fig. 4E); always cut by three transverse sulci (1) (Figs. 4D,F)
9. Prozone and metazone length: prozone shorter than metazone (0) (Fig. 4E); prozone slightly shorter than metazone (1) (Fig. 4F); subequal (2) (Fig. 4D)
10. Hind femora: robust (0) (Fig. 4B); thin (1) (Fig. 4A); intermediate (2) (Fig. 4C)

#### Male abdominal terminalia

11. Subgenital plate: short, with rounded apex (0) (Figs. 4K-L); long, with acute and bifurcate apex (1) (Fig. 4J)
12. Epiproct: oval with pointed caudal edge (0) (Fig. 4K); triangular (1) (Fig.4L); rhomboidal with rounded edges (2); rhomboidal with angulated edges (3) (Fig. 4J);
13. Epiproct with tubercles: present (0) (Fig. 4K); absent (1) (Fig. 4J,L)
14. Furculae: reduced (0) (Fig. 4L); intermediate (1) (Fig.4J); prominent (2) (Fig. 4K)
15. Furculae: placed far apart (0) (Figs. 4J-L); placed close together (1)

Male phallic complex

16. Expansion of rami extending into the ventral valve of aedeagus: present (0) (Fig. 5B); absent (1) (Fig. 5A,C)
17. Dorsal valves of aedeagus: down curved (0) (Fig. 5B); up curved (1) (Fig. 5A); absent (2) (Fig. 5C)
18. Lophi of epiphallus: slightly prominent, widely developed horizontally (0) (Fig. 5E); prominent with pointed edges (1) (Fig. 5F); prominent, subrectangular with rounded edges (2); prominent, subrectangular with pointed edges (3); prominent, subrectangular with oblique edges (4) (Fig. 5D)

Chromatic characters

19. General coloration: brownish, dark mottled (0) (Fig. 4B); greenish, not mottled (1) (Fig. 4A); brightly colored, not mottled (2) (Fig. 4C)
20. Color pattern of body and hind femora: with bands or spots in characteristic patterns (0) (Fig. 4A-C); uniformly green (1)
21. Color pattern of hind tibiae: without bands, yellow and tips brown (0) (Fig. 4B); without bands, greenish and tips bright red (1) (Fig. 4A); without bands, salmon, light red or reddish (2); with bands, areas or spots, fuscous or black and yellow, red or orange (3). (Fig. 4C)
22. Color pattern of pronotum: with longitudinal and oblique bands (0) (Fig. 4E); with longitudinal bands (1) (Fig. 4D,F); with transverse bands (2); without bands (3)
23. Color pattern of tegmina: with dark mottles (0) (Fig. 4B); homogeneous reddish brown (1) (Fig. 4C); without mottles and spots (2) (Fig. 4A)
24. Color pattern of hind wings: uniformly colored, without black (0); with black in characteristic patterns (1)
25. Integument on metazone: delicately rugose (0) (Fig. 4B); strongly impreso punctate (1) (Fig. 4C); impreso punctuate (2); coarsely rugose, with the upper parts of the rugae of different color (3); strongly rugose (4); tuberculate (5); coarsely rugose, with upper parts of the rugae of same color (6) (Fig. 4A).

APPENDIX 2. Data matrix used in the phylogenetic analysis of *Zoniopoda*.

	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
<i>D. cribratus</i>	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
<i>C. speciosa</i>	1	0	0	1	1	0	3	0	1	1	2	0	1	1	0	0	1	2	1	2	0	3	1	1	1	1
<i>Z. tarsata</i>	1	1	1	1	1	1	2	0	1	2	1	1	2	1	0	0	1	1	2	2	0	3	1	2	0	3
<i>Z. omnicolor</i>	1	1	1	1	1	1	0	0	1	2	1	1	3	1	0	0	1	1	2	2	0	3	1	2	0	2
<i>Z. exilipes</i>	1	1	1	1	1	1	2	0	1	2	1	1	2	1	0	1	1	1	2	2	0	3	2	2	0	2
<i>Z. fissicauda</i>	1	1	1	1	1	1	2	0	1	2	1	1	2	1	0	0	1	1	2	2	0	3	2	2	0	2
<i>Z. danottei</i>	1	1	1	1	1	1	2	0	1	2	1	1	2	1	0	0	1	1	2	2	0	3	1	2	0	4
<i>Z. iheringi</i>	1	1	1	1	1	1	1	1	1	2	1	1	2	1	0	1	1	1	2	1	1	2	3	2	0	5
<i>Z. juncorum</i>	1	1	1	1	1	1	2	1	1	2	1	1	3	1	0	1	1	1	2	1	1	2	3	2	0	5
<i>Z. similis</i>	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	1	1	1	2	1	1	1	1	2	0	6
<i>Z. mimicula</i>	1	1	1	1	1	1	0	1	1	2	1	1	0	1	0	1	1	1	3	1	1	2	3	2	0	6
<i>Z. hempeli</i>	1	1	1	1	1	1	2	1	1	2	1	1	3	1	0	0	1	1	3	1	1	2	3	2	0	6
<i>Z. serrana</i>	1	1	1	1	1	1	1	1	1	2	1	1	3	1	1	0	1	1	4	1	0	1	1	2	0	6